RevMexAA (Serie de Conferencias), **40**, 225–226 (2011)

THE CIDA-VISTA SURVEY IN ORION OB1

C. Briceño,[1] C. Mateu,[1] J. J. Downes,[1] A. K. Vivas,[1] J. Hernández,[1] N. Calvet,[2] and the VISTA Galactic Science Verification Team

RESUMEN

Presentamos los resultados preliminares de un sondeo óptico-infrarrojo sobre un área de ∼30 grados^2 en la asociación Orión OB1, en las regiones extra-nube, donde las poblaciones estelares jóvenes son más evolucionadas. La combinación de un sondeo óptico multi-época con un mapeo profundo en el cercano infrarrojo, abre una ventana a lo que podemos esperar de la nueva generación de sondeos a gran escala como VISTA y LSST.

ABSTRACT

We present the preliminary results of an optical-infrared survey spanning an area ∼30 deg^2 in the Orion OB1 association, across the off-cloud regions, where the young stellar populations are more evolved. The combination of a multi-epoch optical survey with a deep mapping in the near-infrared, opens a window into what we can expect of the new generation of large scale surveys like VISTA and LSST.

Key Words: open clusters and associations: individual (Orion OB1) — stars: low-mass — stars: pre-main sequence

1. ORION OB1

Most stars the Galaxy were formed in OB associations, vast complexes containing both high and low mass stars, and exhibiting all the stages of star formation and early stellar evolution (Briceño et al. 2007a).

The Orion OB1 association is one of the nearest ($d \sim 400$ pc) large giant molecular cloud complexes, a region of about 75 pc in diameter, in which the process of star formation has proceeded during at least 10 million years (Blaauw 1964; Briceño 2008). With a wide range of ages and environmental conditions, Orion exhibits all stages of the star formation process, from very young, embedded clusters, to older, fully exposed OB associations, as well as both clustered and distributed populations. Despite its proximity its full stellar population has not been thouroughly studied, in part because the large extent of Orion on the sky has made comprehensive surveys difficult until recently, resulting in that almost all existing studies have concentrated on the youngest stars projected onto the molecular clouds, which only offer a snapshot of the present moment of star formation in this complex.

[1]Centro de Investigaciones de Astronomía, Apdo. Postal 264, Mérida 5101, Venezuela (briceno@cida.ve).

[2]University of Michigan, Astronomy Department, 500 Church St., 857 Dennison, Ann Arbor, MI 48109, USA (ncalvet@umich.edu).

2. SEARCHING FOR THE LOWEST MASS STARS AND DISKS IN THE ORI OB1 OFF-CLOUD POPULATION

In order to build a complete picture of star formation in Orion, a comprehensive census of the widely distributed, more evolved young stellar populations is needed. This has been the goal of the CIDA-Variability Survey of Orion (CVSO; Briceño et al. 2001). The problem in studying more evolved pre-main sequence stars has been finding a suitable sample. These elusive objects are much more difficult to identify than their younger counterparts, because their parent molecular clouds have long since dissipated, and no longer serve as markers of these populations (Briceño et al. 2001, 2005, 2007a).

The CVSO is a wide-area survey spanning ∼180 deg^2 across most of the Orion OB1 association, with an emphasis on the off-cloud regions, namely the ∼4 Myr old Ori OB1a sub-association, which encompasses the Orion belt stars, and the widely extended ∼10 Myr old OB1a region to the west of the A and B molecular clouds (Figure 1). The CVSO was also conceived as a synoptic survey, taking advantage of the fact that photometric variability is a defining characteristic of all solar-like pre-main sequence (PMS), ever since their discovery (Joy 1945). The effectiveness of photometric variability to detect young stars in the off-cloud regions, traditionally very difficult to identify through other methods has been demonstrated by the discovery of the 25 Ori cluster, an aggregate of over 200 PMS stars surrounding the B2 star 25 Orionis (Briceño et al. 2007b). There-

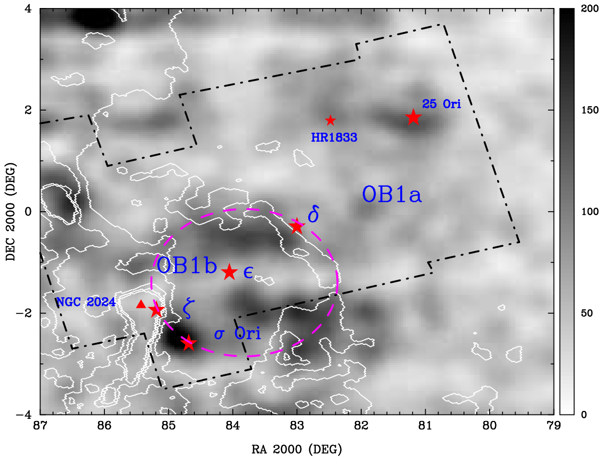

Fig. 1. The surface density of candidate PMS stars in the CVSO, selected for being detected as variable and located above the main sequence in color-magnitude diagrams (grey scale map). The area of the VISTA ZYJHK galactic science verification study is indicated by the dash-dot line. The two main sub-associations in Orion are indicated: the ∼4 Myr old OB1b (dashed line circle) and older (∼10 Myr), more extended OB1a. The three bright stars of Orion's belt, 25 Ori and σ Ori are plotted as large stars; NGC 2024 is indicated by a triangle. The CVSO-VISTA dataset encompasses a ~ 30 deg^2 area that includes almost the entire OB1b region and part of OB1a, including the recently discovered 25 Ori cluster (Briceño et al. 2007b). Among several stellar overdensities revealed by this map is the HR 1833 group, just east of 25 Ori.

fore, the CVSO is providing for the first time the "big picture" of star formation in Orion.

Recently, the European Southern Observatory (ESO) recemtly comissioned its Visible and IR Survey Telescope for Astronomy (VISTA). The galactic science verification for the telescope was decided to be carried out in Orion OB1, as a combination of a multi-band mini survey and a synoptic observation of a smaller region of particular interest. The YZJHK survey was done over ∼30 deg^2 area encompassing almost all of Ori OB1b and several square degrees across the older OB1a region, including the 25 Ori cluster, plus an extension toward the Orion B cloud, which included the NGC 2024 and σOri clusters. For the multi-epoch observations we targeted the 25 Ori cluster in the J and H bands. The VISTA observations in Orion reach about 4 magnitudes deeper than 2MASS, to limits of $J \sim 20.2$, $H \sim 19.2$, $K \sim 18.4$, $Z \sim 22.7$, $Y \sim 21.0$. This dataset, combined with the CVSO optical catalogs offer a powerful tool to look for very low mass young stars, young brown dwarfs and detect near-IR excess emission from warm dusty inner disks.

3. PRELIMINARY RESULTS

• The spatial distribution of young populations in OB1a and OB1b is highly structured. We find several new stellar groupings, in addition to the 25 Ori cluster. An example is an overdensity just west of 25 Ori, located around the B2V star HR 1833; another is the ϵ Ori group (located just south-west of the central star of Orion's belt). The existence of these groups shows that spatial structure can survive in these associations even after 10 Myr, though the groups themselves are probably gravitationally unbound.

• Brown dwarfs seem to be distributed similarly to their higher mass stellar counterparts, This suggests a similar formation processes or that both brown dwarfs and low-mass stars had similar early dynamical evolution.

• We find that the fraction of near-IR excesses, attributed to excess emission from warm inner disks, evolve in brown dwarfs similar to what is observed in higher mass (solar-like) TTS (Briceño et al. (2007b); though brown dwarfs seem to have somewhat higher disk fractions).

The combination of the synoptic CVSO with the VISTA mini-survey of Orion offer a window into what we can expect from upcoming surveys like VISTA and LSST.

REFERENCES

Blaauw, A. 1964, ARA&A, 2, 213
Briceño, C., et al. 2001, Science, 291, 93
Briceño, C., et al. 2005, AJ, 129, 907
Briceño, C., Preibisch, T., Sherry, W. H., Mamajek, E. E., Mathieu, R. D., Walter, F. M., & Zinnecker, H. 2007a, in Protostars & Planets V, ed. B. Reipurth, D. Jewitt, & K. Keil (Tucson: Univ. Arizona Press), 345
Briceño, C., et al. 2007b, ApJ, 661, 1119
Briceño, C. 2008, Handbook of Star Forming Regions, Vol.1 The Northern Sky, ed. B. Reipurth (San Francisco ASP), 838
Joy, A. H. 1945, ApJ, 102, 168